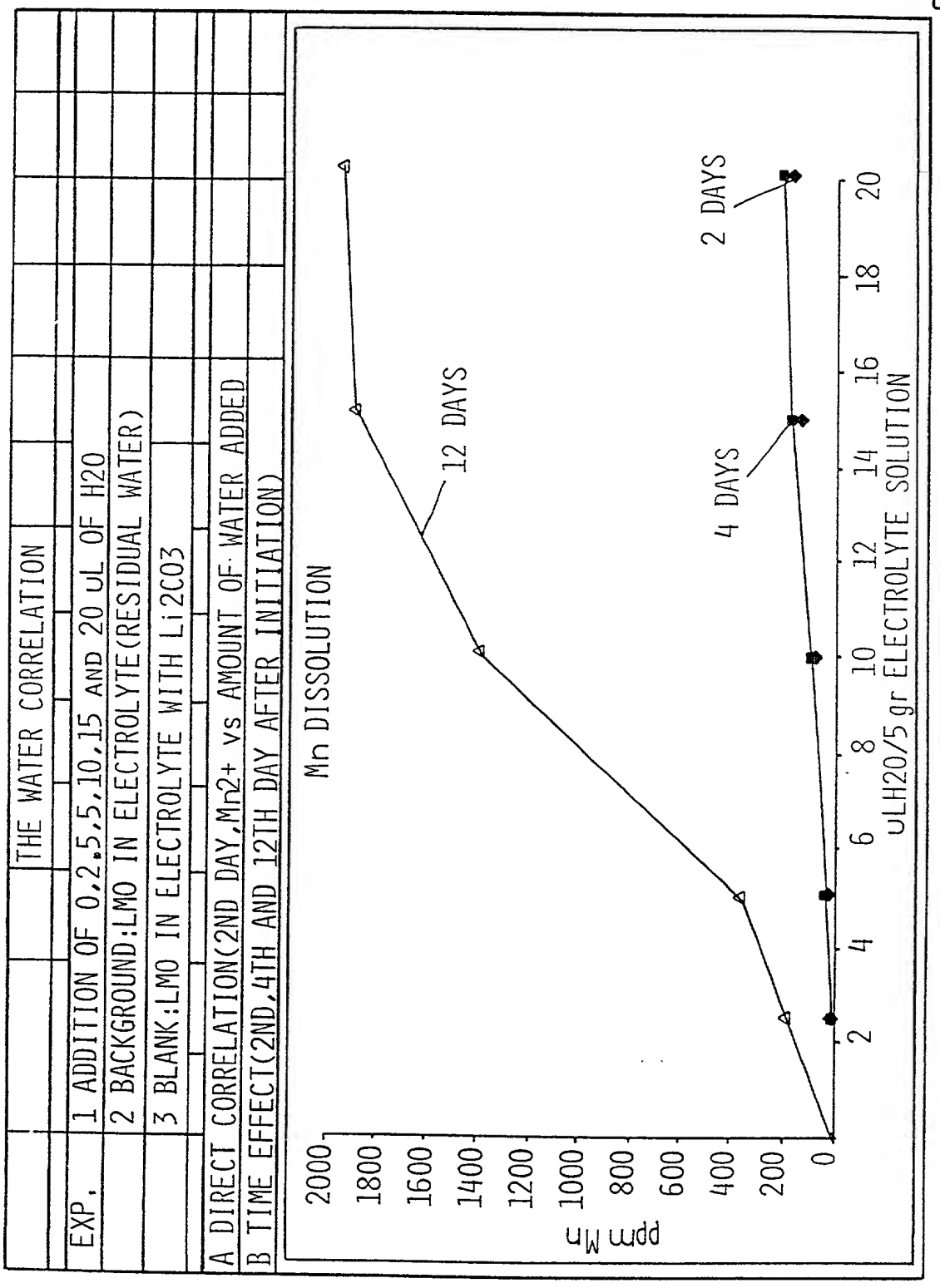

THE WATER CORRELATION
EXP.
1 ADDITION OF 0,2,5,5,10,15 AND 20 uL OF H2O
2 BACKGROUND:LMO IN ELECTROLYTE(RESIDUAL WATER)
3 BLANK:LMO IN ELECTROLYTE WITH Li2CO3
A DIRECT CORRELATION(2ND DAY,Mn2+ vs AMOUNT OF WATER ADDED
B TIME EFFECT(2ND,4TH AND 12TH DAY AFTER INITIATION)
Mn DISSOLUTION
ppm Mn
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2
4
6
8
10
12
14
16
18
20
uLH20/5 gr ELECTROLYTE SOLUTION
12 DAYS
4 DAYS
2 DAYS

FIG.1

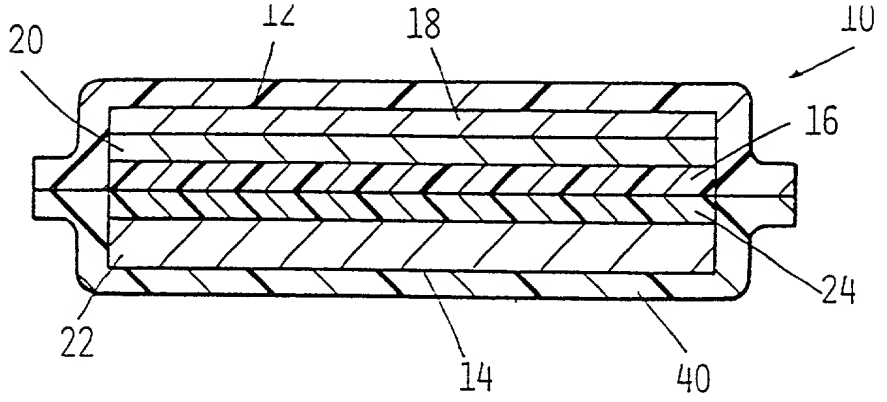

20
12
18
10
16
24
22
14
40

FIG. 2

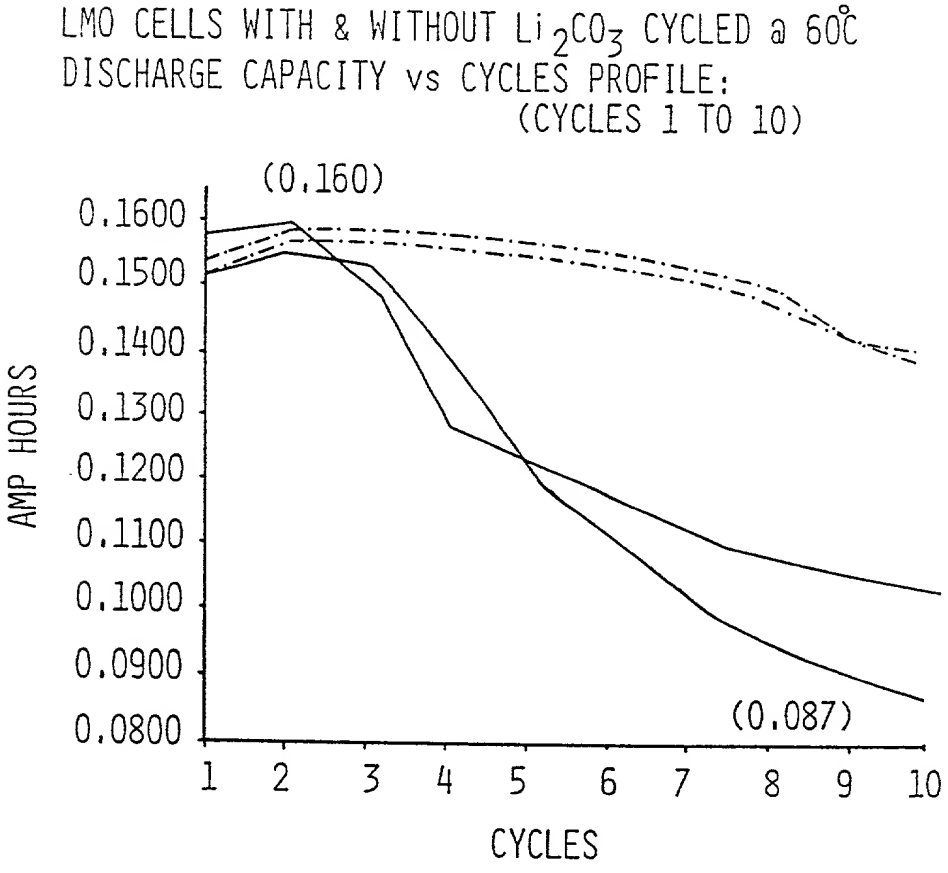

LMO CELLS WITH & WITHOUT Li_2CO_3 CYCLED a 60°C
DISCHARGE CAPACITY vs CYCLES PROFILE:
(CYCLES 1 TO 10)
(0.160)
0.1600
0.1500
0.1400
0.1300
0.1200
0.1100
0.1000
0.0900
0.0800
AMP HOURS
(0.087)
1
2
3
4
5
6
7
8
9
10
CYCLES

FIG. 3

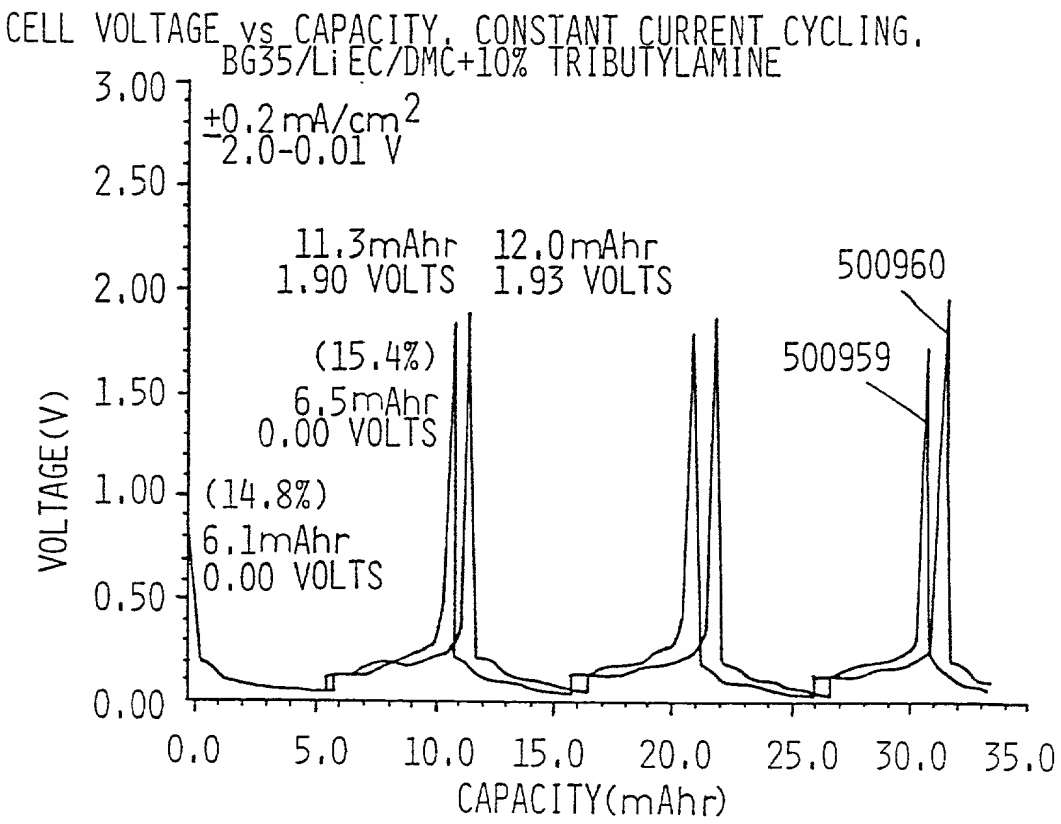

CELL VOLTAGE vs CAPACITY, CONSTANT CURRENT CYCLING.
BG35/Li EC/DMC+10% TRIBUTYLAMINE
±0.2 mA/cm2
2.0-0.01 V
11.3mAhr
1.90 VOLTS
12.0mAhr
1.93 VOLTS
500960
500959
(15.4%)
6.5mAhr
0.00 VOLTS
(14.8%)
6.1mAhr
0.00 VOLTS
VOLTAGE(V)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
CAPACITY(mAhr)

FIG. 4

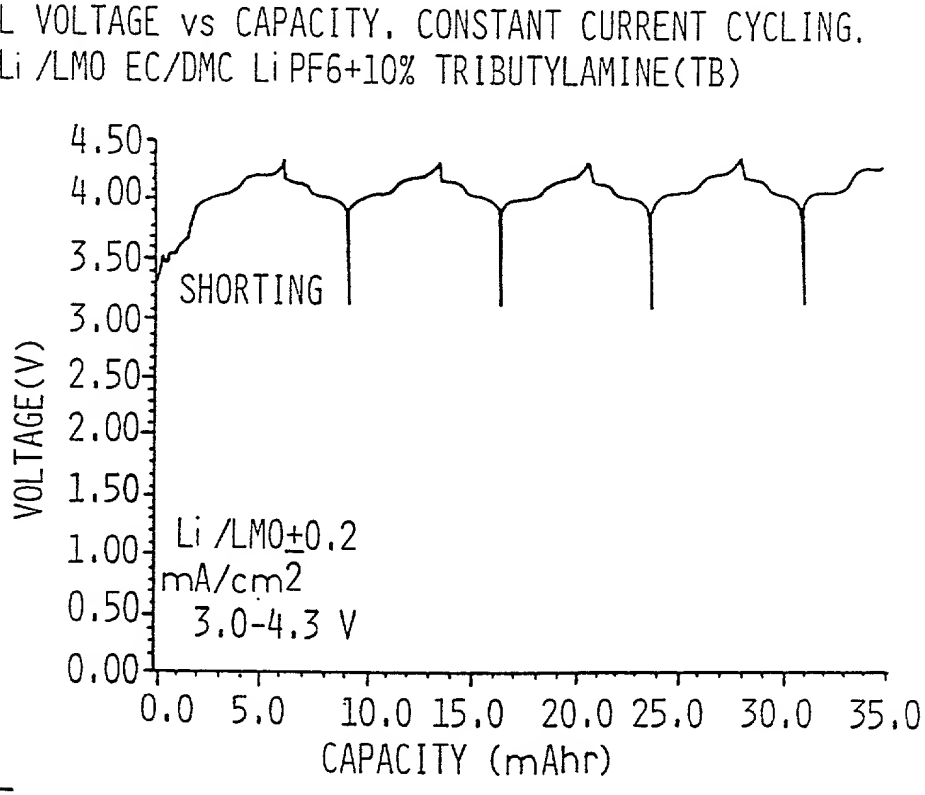

CELL VOLTAGE vs CAPACITY, CONSTANT CURRENT CYCLING.
Li /LMO EC/DMC LiPF6+10% TRIBUTYLAMINE(TB)
SHORTING
Li /LMO±0.2
mA/cm2
3.0-4.3 V
VOLTAGE(V)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
CAPACITY (mAhr)

FIG. 5

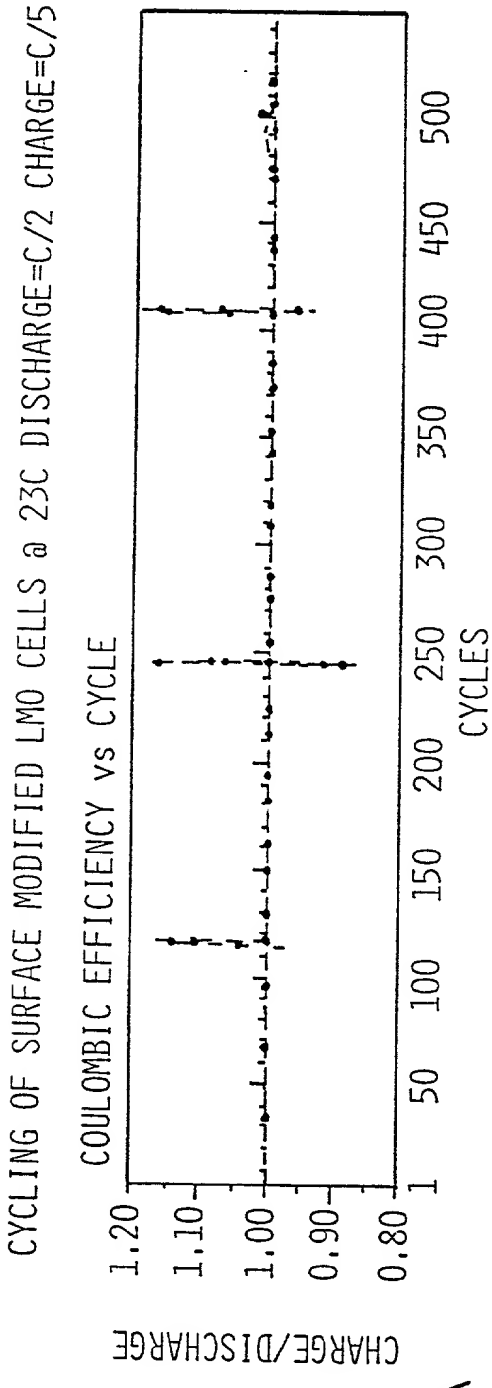

CYCLING OF SURFACE MODIFIED LMO CELLS a 23C DISCHARGE=C/2 CHARGE=C/5
COULOMBIC EFFICIENCY vs CYCLE
CHARGE/DISCHARGE
1,20
1,10
1,00
0,90
0,80
1
50
100
150
200
250
300
350
400
450
500
CYCLES

FIG.6A

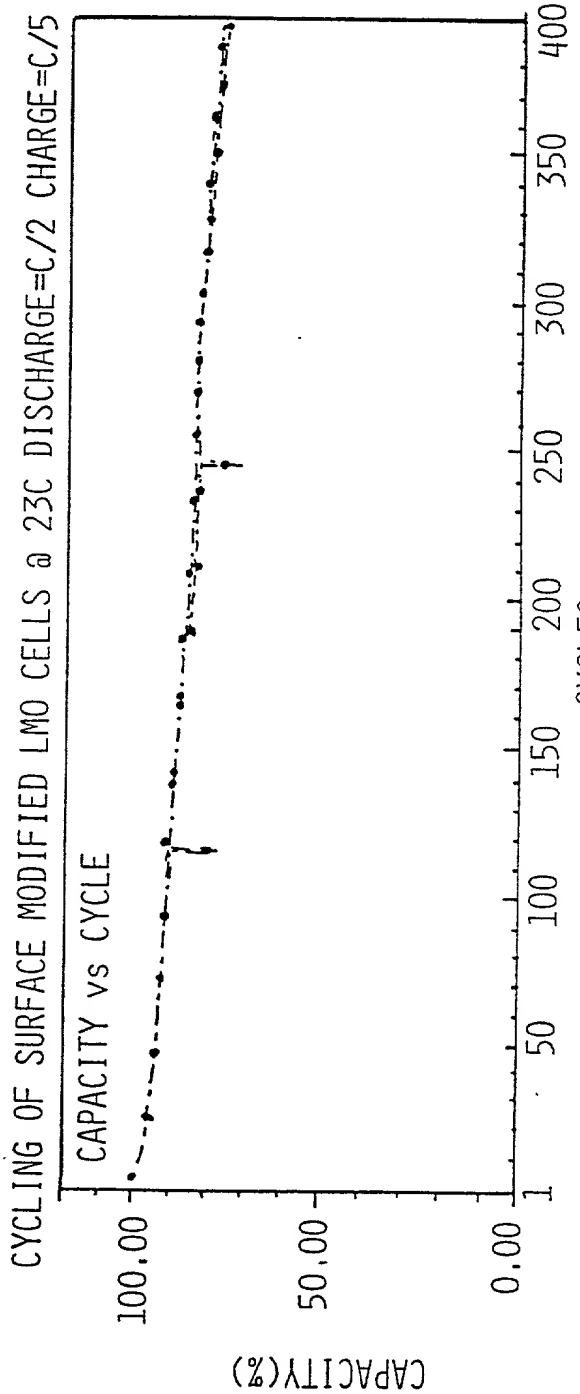
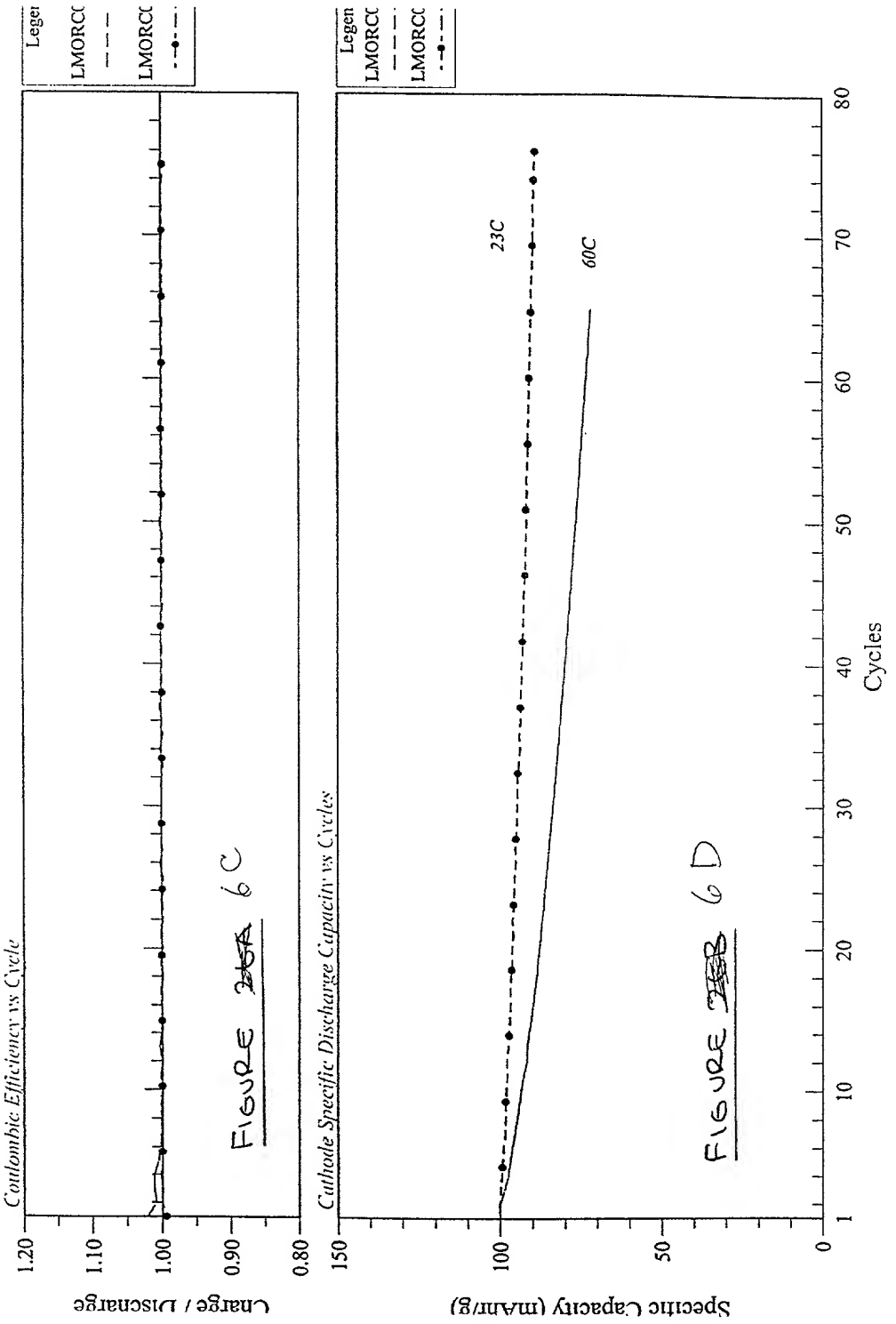

CYCLING OF SURFACE MODIFIED LMO CELLS a 23C DISCHARGE=C/2 CHARGE=C/5
CAPACITY vs CYCLE
CAPACITY(%)
100,00
50,00
0,00
1
50
100
150
200
250
300
350
400
CYCLES

FIG.6B



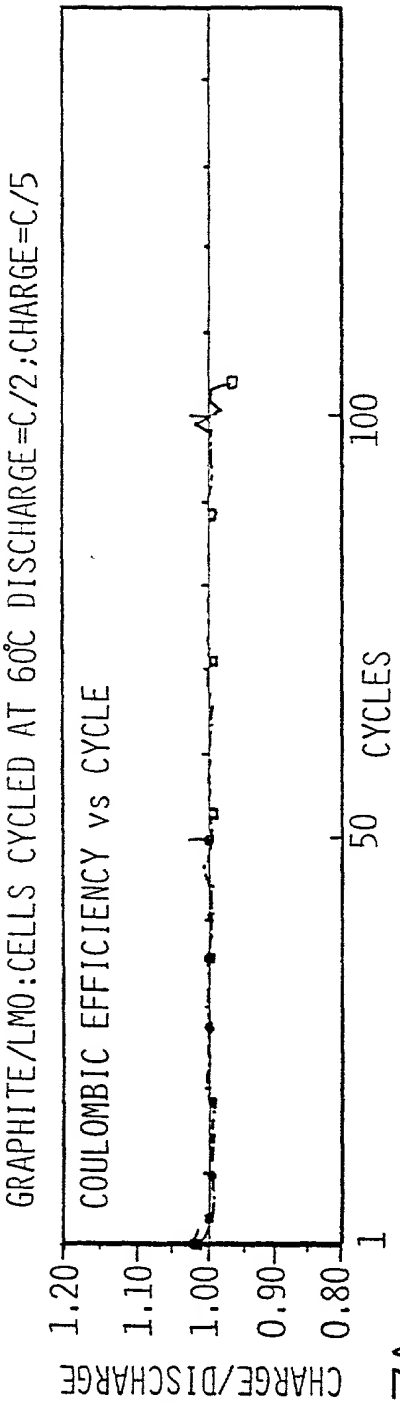

GRAPHITE/LMO:CELLS CYCLED AT 60C DISCHARGE=C/2;CHARGE=C/5
COULOMBIC EFFICIENCY vs CYCLE
CHARGE/DISCHARGE
1.20
1.10
1.00
0.90
0.80
1
50
100
CYCLES

FIG. 7A

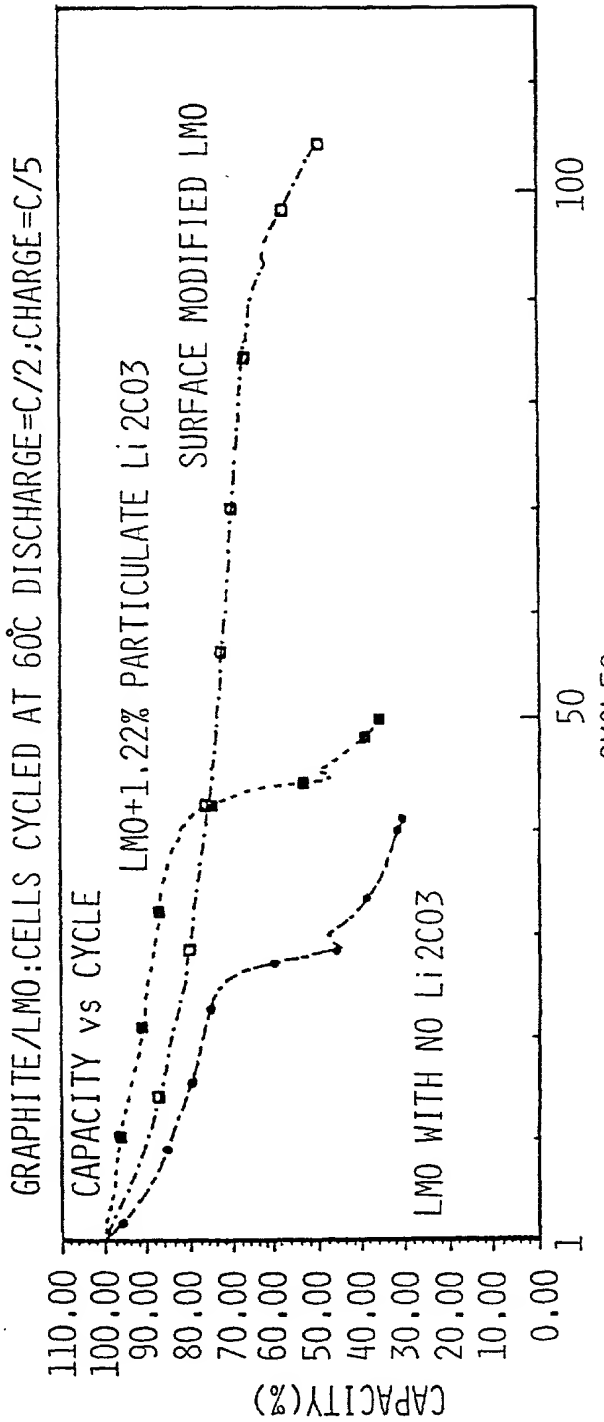

GRAPHITE/LMO:CELLS CYCLED AT 60C DISCHARGE=C/2;CHARGE=C/5
CAPACITY vs CYCLE
LMO+1.22% PARTICULATE Li2CO3
SURFACE MODIFIED LMO
LMO WITH NO Li2CO3
CAPACITY(%)
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1
50
100
CYCLES

FIG. 7B

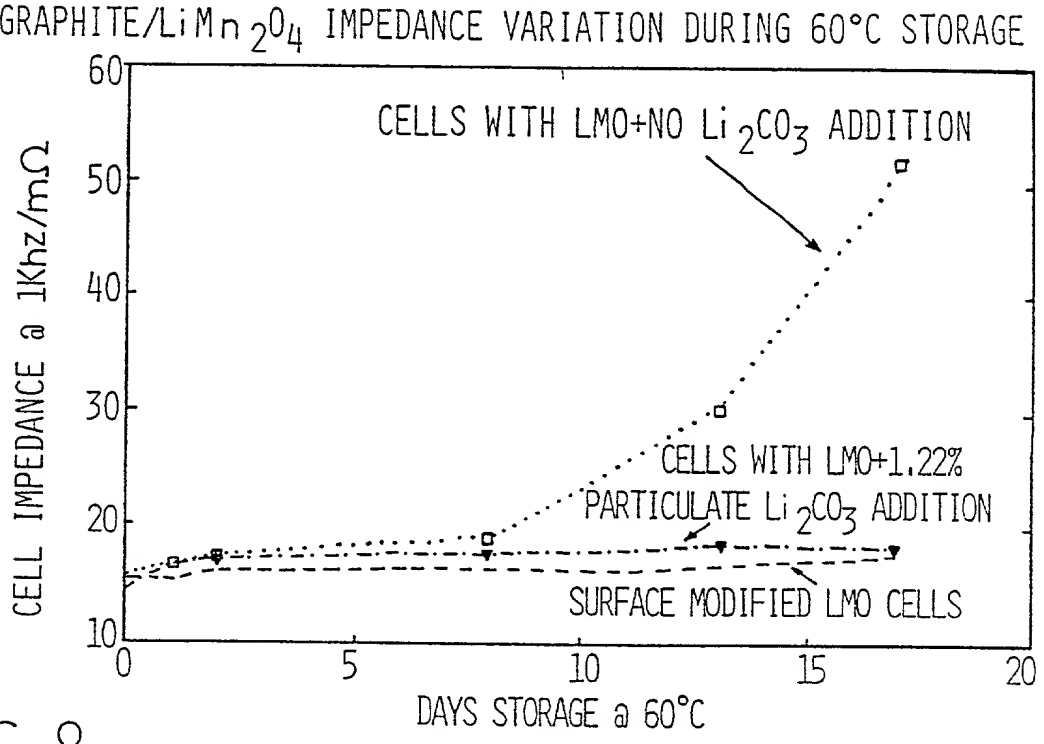

GRAPHITE/LiMn2O4 IMPEDANCE VARIATION DURING 60°C STORAGE
CELL IMPEDANCE a 1Khz/mΩ
60
50
40
30
20
10
0
5
10
15
20
DAYS STORAGE a 60°C
CELLS WITH LMO+NO Li2CO3 ADDITION
CELLS WITH LMO+1.22%
PARTICULATE Li2CO3 ADDITION
SURFACE MODIFIED LMO CELLS

FIG. 8

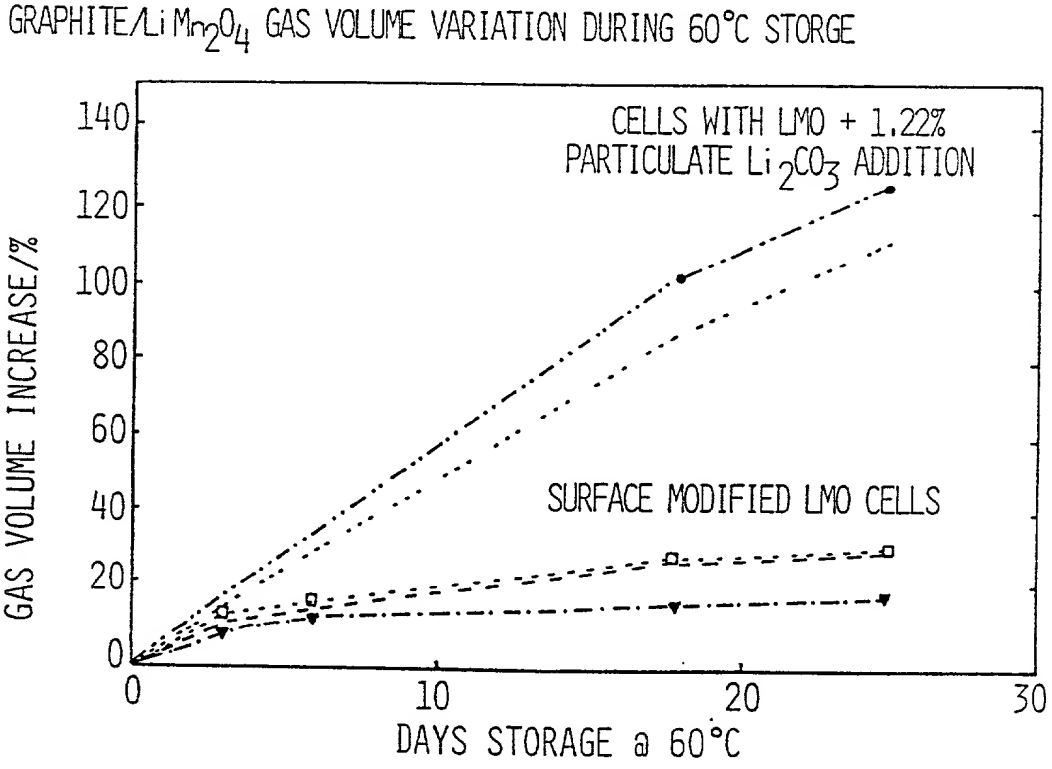

GRAPHITE/LiMn2O4 GAS VOLUME VARIATION DURING 60°C STORGE
GAS VOLUME INCREASE/%
140
120
100
80
60
40
20
0
0
10
20
30
DAYS STORAGE a 60°C
CELLS WITH LMO + 1.22%
PARTICULATE Li2CO3 ADDITION
SURFACE MODIFIED LMO CELLS

FIG. 9

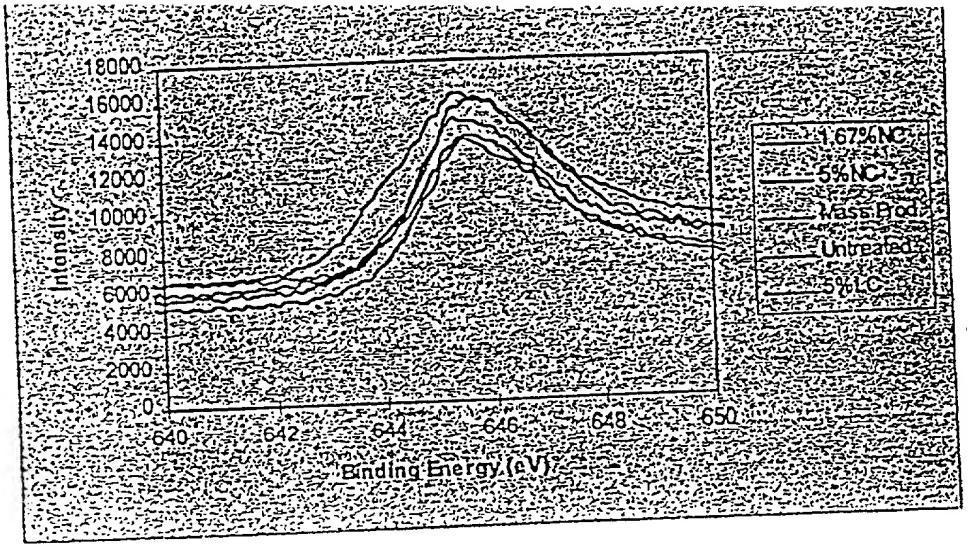

Intensity
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
640
642
644
646
648
650
Binding Energy (eV)
1.67% NC
5% NC
Mass Prod.
Untreated
5% LC

Fig 10

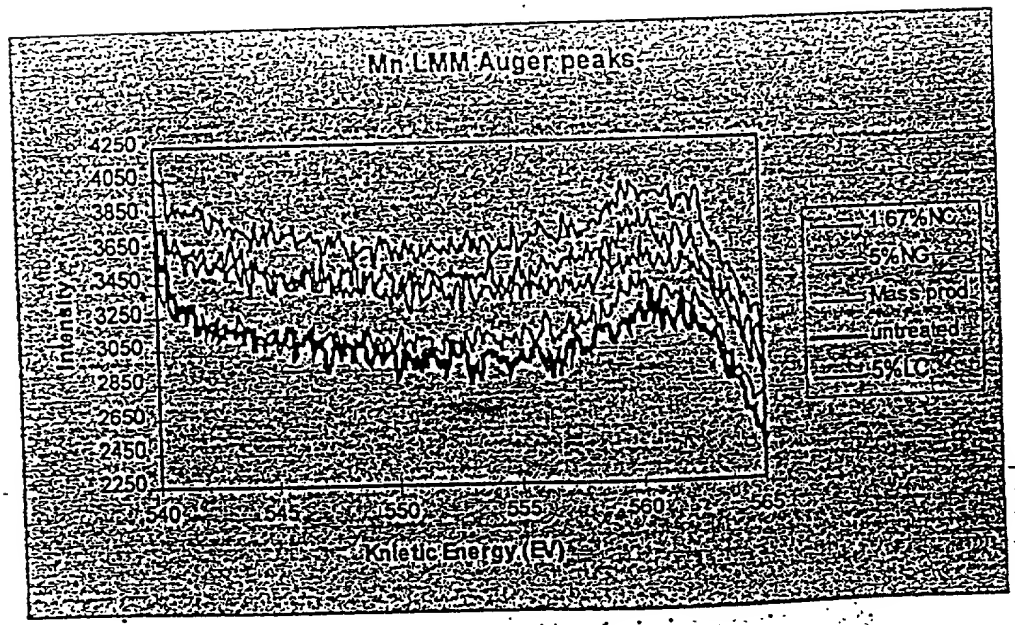

Mn LMM Auger peaks
Intensity
4250
4050
3850
3650
3450
3250
3050
2850
2650
2450
2250
540
545
550
555
560
Kinetic Energy (eV)
1.67% NC
5% NC
Mass prod.
untreated
5% LC

Fig 11

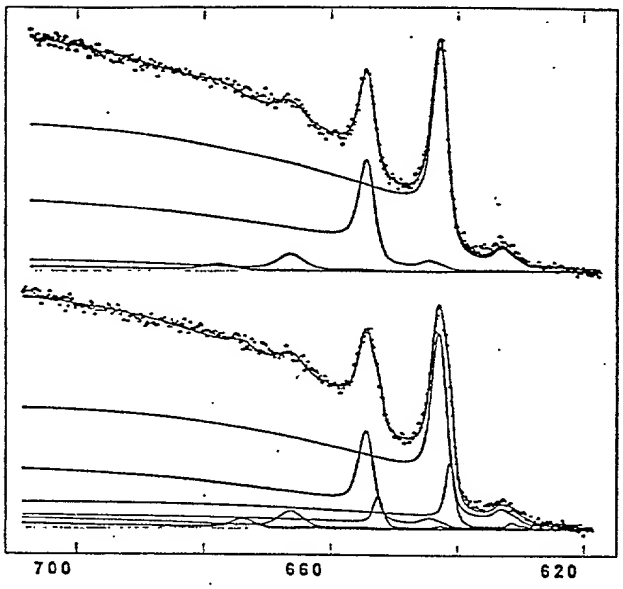

700
660
620

Fig 12

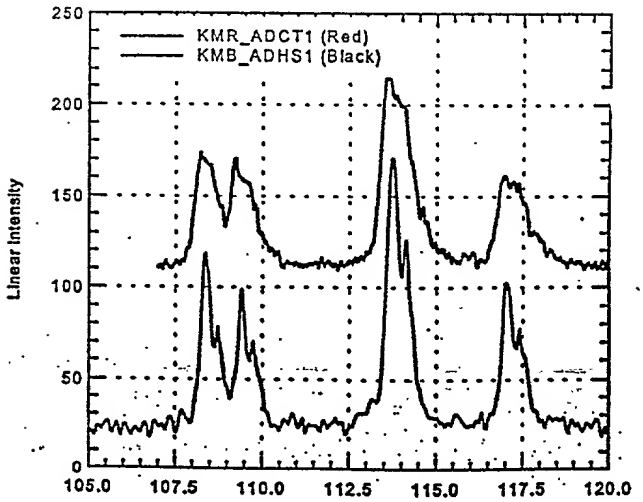
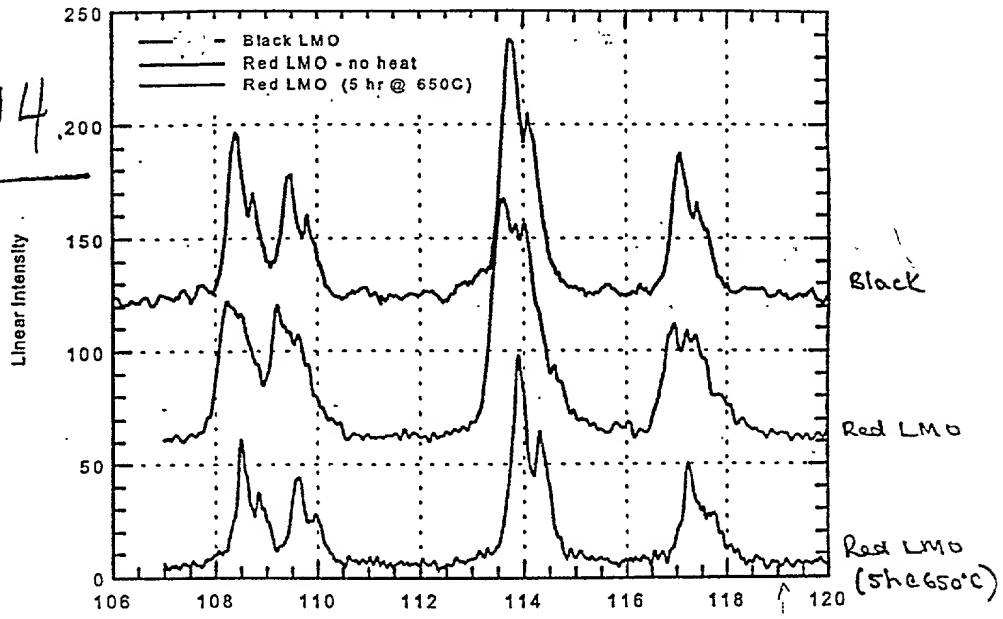

KMR_ADCT1 (Red)
KMB_ADHS1 (Black)
Linear Intensity
250
200
150
100
50
0
105.0
107.5
110.0
112.5
115.0
117.5
120.0

Fig 13

Fig 14


Black LMO
Red LMO - no heat
Red LMO (5 hr @ 650C)
Linear Intensity
250
200
150
100
50
0
106
108
110
112
114
116
118
120
Black
Red LMO
Red LMO (5hr@650°C)

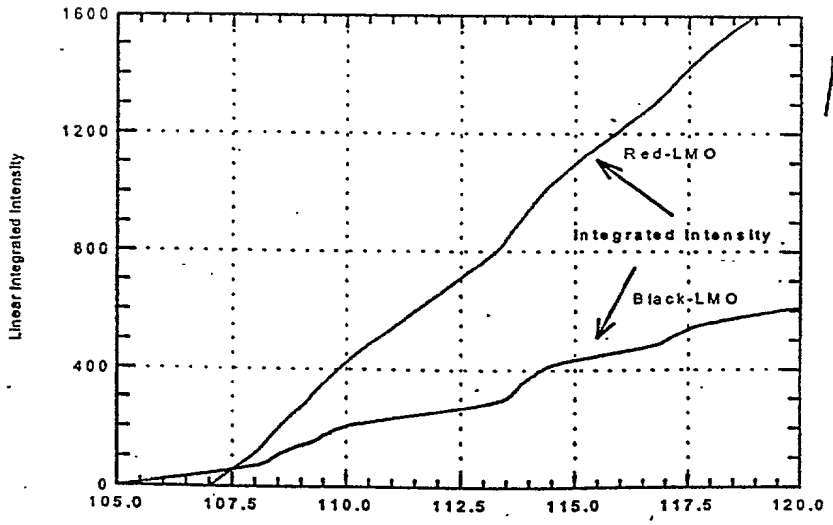

Linear Integrated Intensity
1600
1200
800
400
0
105.0
107.5
110.0
112.5
115.0
117.5
120.0
Red-LMO
Integrated Intensity
Black-LMO

Fig 15